

## REVISIONARY NOTES ON THE GENUS *DELMA* (SQUAMATA: PYGOPODIDAE) IN SOUTH AUSTRALIA AND THE NORTHERN TERRITORY.

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Nine species of *Delma* are recorded from South Australia and the Northern Territory: *D. australis*, *D. borea*, *D. butleri*, *D. fraseri*, *D. impar*, *D. inornata*, *D. molleri*, *D. nasuta* and *D. tincta*. *D. australis* is formally recorded from New South Wales for the first time. *D. haroldi* is synonymised with *D. butleri*. A neotype is designated for *D. fraseri*, and an eastern race, *D. f. petersoni* described, having a greater number of scale rows at midbody and a bolder throat pattern. *D. borea*, *D. pax* and *D. tincta* are placed in a *D. tincta* species group, while *D. impar*, *D. plebeia* and *D. torquata* are placed in a *D. impar* species group.

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The genus *Delma* is the most speciose genus in the family Pygopodidae. In the most recent revision, Kluge (1974) recognised 13 species, of a total of 30 species in the family. Since that time, museum herpetological collections in Australia have tripled in size, while extensive collections have been made in remote and formerly poorly-studied areas. Within the last four years, the genus has been the subject of attention in the eastern and western thirds of Australia. In eastern Australia, Shea (1987a, b) described two new species *D. labialis* and *D. mitella* from Queensland, recorded the presence of *D. nasuta* in New South Wales, and provided updated spot distribution maps for most taxa occurring in the region. In Western Australia, Storr (1987) and Storr *et al.* (1990) divided *D. nasuta* into two species (one new), described a second new species *D. haroldi*, briefly redescribed the remaining taxa, and provided distribution maps for the state.

This paper links these studies by revising the genus in the intervening area (South Australia and the Northern Territory) for the first time since Kluge's (1974) revision, and discusses the identity of *D. fraseri*, type species of the genus.

Although the monophyly of the genus is an unresolved issue (Shea 1987a), there is little doubt that the species placed in *Delma* by recent workers are at least a close-knit grade, readily differentiated from both more derived and relatively primitive members of the family (Kluge 1976), and for this paper I accept the phenetic diagnosis of the genus provided by Kluge (1974).

### MATERIALS AND METHODS

This study is based on the examination of material in the Australian Museum (AM), British

Museum (Natural History) (BMNH), Museum of Victoria (MV), Northern Territory Museum (NTM), Queensland Museum (QM), South Australian Museum (SAM), Western Australian Museum (WAM) and Central Australian Wildlife Collection (CAWC), the latter collection now lodged in the Northern Territory Museum.

Scalation nomenclature follows Shea (1987a) with one exception. The second supralabial scale caudal to the elongate subocular supralabial has previously been generally considered to be the caudalmost (Kluge 1974; Shea 1987a; Storr 1987). However, in specimens preserved with open mouth, the third supralabial scale caudal to the subocular supralabial is at the caudalmost extent of the circumoral scalation. Hence, the supralabial and infralabial scale counts used here are one greater than counts in previous works.

I have used only derived characters to hypothesise relationships between taxa, and have used *Pygopus lepidopodus* and *P. nigriceps*, the two most generally primitive species in the family (Kluge 1974, 1976) as outgroups to determine polarity of characters.

### SYSTEMATICS

#### *Delma australis* Kluge, 1974: 77.

##### *Diagnosis*

A small species of *Delma* (maximum SVL 88 mm), with ventral body scales not markedly dilated relative to more lateral scales, a single pair of supranasal scales, modally 18 midbody scales and fourth supralabial in subocular position, loreal scale row usually interrupted by a ventral extension of

prefrontal scale contacting supralabials, and body venter grey (often tinged with pink in life).

#### Description

See Kluge (1974) and Storr *et al.* (1990).

#### Distribution

In South Australia, occurs in the south-west, from the Western Australian border east to the Flinders

Ranges, and including the southern fringe of the Great Victoria Desert, Gawler Ranges and Eyre Peninsula. Apparent isolates in the western part of the Lake Eyre drainage, the Tomkinson and Musgrave Ranges, Danggali Conservation Park, and to the south of the Murray River, between Tailem Bend and Scorpion Well Conservation Park (Fig. 1).

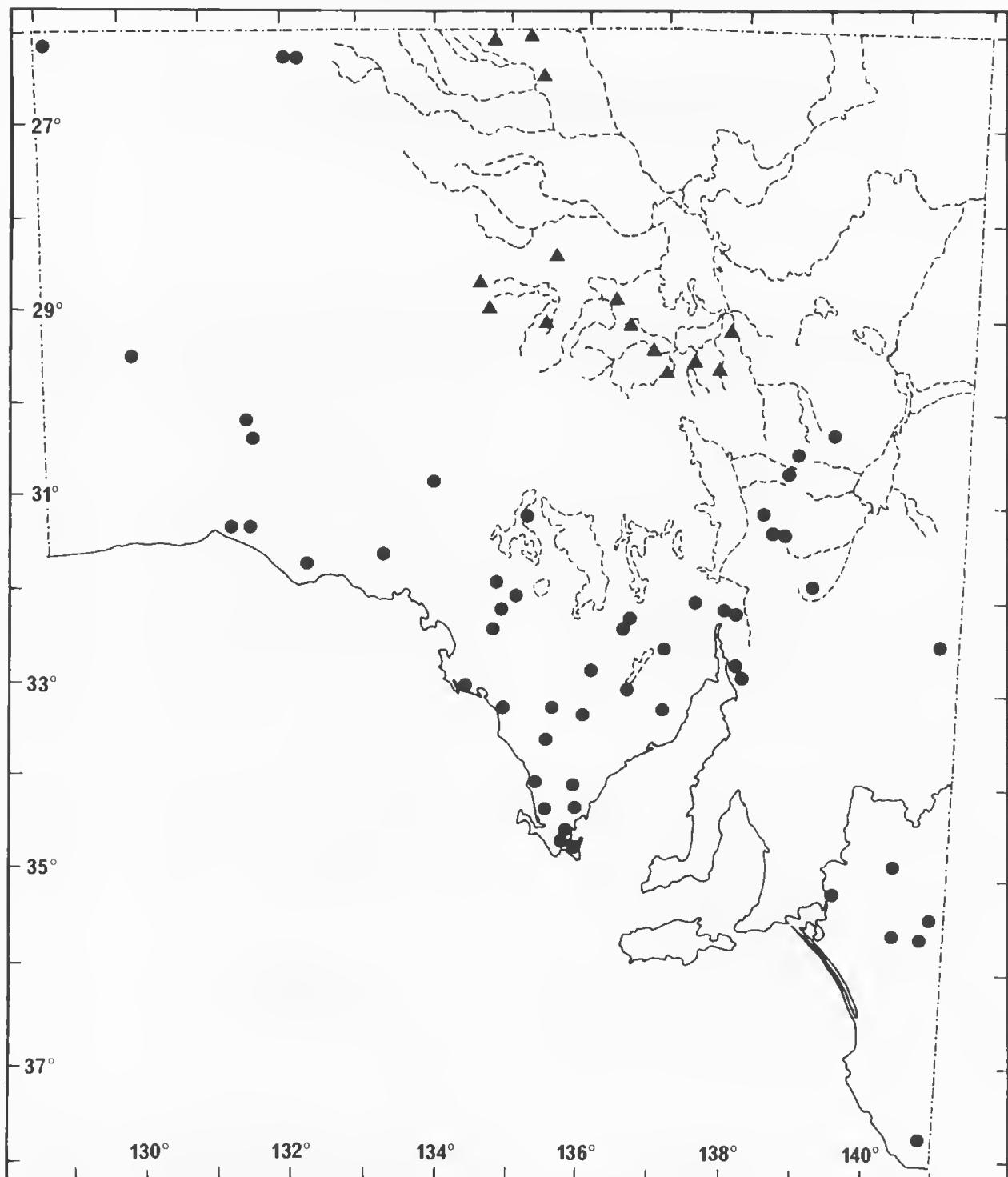


FIGURE 1. Distribution of *Delma australis* in South Australia. Triangles represent weakly patterned north-eastern population.

Also occurs in southern W.A., south-west N.S.W. and north-west Victoria (Kluge 1974; Storr *et al.* 1990; this paper).

#### Remarks

There is noticeable geographic variation in the intensity of the head pattern in this species in South Australia. Most specimens from the southern half of the state and the Tomkinson and Musgrave Ranges in the north-west have strong dark variegations on the head, although the pattern is reduced, particularly laterally, in a few specimens. Material from the western part of the Lake Eyre drainage (east of 134°E, north of 30°S) consistently either lack dark markings on the head or have such markings very reduced.

The single old record from the Northern Territory (SAM R2240; Alice Springs, no collector or date recorded) was considered to be suspect by Kluge (1974). Extensive collections of reptiles from the Alice Springs area since the early 1970s have included numerous *Delma tincta*, and several *D. borea*, *D. butleri* and *D. nasuta*, but no additional material of *D. australis*. Consequently, I consider the locality for SAM R2240 erroneous.

*Delma australis* has not previously been formally recorded from New South Wales, although Cogger (1975) maps the species in the south-west corner of the state. Five specimens (AM R39495, R55010, R93142, R118635, R118637) confirm the presence of the species in New South Wales.

#### Habitat

The majority of specimens of the southern and western populations in South Australia are from *Triodia* or mallee habitats, or combinations of both (45 specimens from 24 localities), generally taken from in or under *Triodia* clumps or mallee leaf litter. The former habitat is shared with *D. butleri*. My impression, having collected both species in W.A., S.A. and N.S.W., including the Coombah area where the two taxa are sympatric, is that *D. australis* occurs in slightly moister situations than *D. butleri*. There is some support for this view from the association of several records with watercourses (SAM R14351 'under dead log near water pond', R16205 'in burrow under *Triodia*, creek flank', R21015 'on bank of watercourse lined with Coolibah (*Eucalyptus microtheca*)', R22193 'under rock near water', R25071-72 'in storm drain along creek').

One specimen, SAM R15009, was 'pit-trapped overnight', suggesting nocturnal activity.

There are almost no habitat data associated with specimens of the north-eastern unpatterned form. SAM R30401 was taken in a pitfall on a gibber plain with *Atriplex*.

#### Specimens examined

**New South Wales:** AM R39495, 'Glenea', 70 mi. N Roto; R55010, 12 km S Matakana; R93142, Round Hill Fauna Reserve; R118635, 14.2 km N Coombah Roadhouse on Silver City Hwy; R118637, 13.5 km N Coombah Roadhouse on Silver City Hwy.

**South Australia (patterned form):** AM R17306-08, Mt Davies, Tomkinson Ranges; R17460, Musgrave Ranges; R62391, nr Sleaford, Port Lincoln; R79914-15, 2-3 km SE Mt Hope; R79916, N side Pillie Lake; R79917, R79919, R79943, SE side Port Lincoln; R79920-21, 8.4 km W Ungarra P.O. by Yeelanina rd; R107950, 15.6 km E Nundroo via Eyre Hwy; NTM R9252, SAM R17752a-b, Marble Range; SAM R380, Mitchell; R3123, Ernabella Mission; R3852, R10374, 15 mi. N Poochera; R3872, 'Kokatha'; R4301, Port Germein Gorge; R5375, R10376, Gawler Ranges; R5613, 5 mi. W Arkaroola; R9189, R9213, Blesing Reserve; R9224, 4 mi. S Baird Bay; R10375, nr 'Kokatha'; R10800, Watson; R12454-55, 'Corunna'; R12481, R12669, Miccollo Hill, 'Siam'; R12670, 3 mi. NW Tailem Bend; R12746-47, Mambray Creek National Park; R12751, R14695, Corunna Hills; R13227, 7 mi. WNW Kenmore Park; R13908, Lake Gilles Conservation Park; R14086, Whaler's Way, Port Lincoln; R14093, Scorpion Well Conservation Park; R14190, R16678, Billiat Conservation Park; R14351, 3 mi. past Moonarie Pass, 30 mi. S Whyalla; R14914, 'Baratta'; R14963, R24514, Mt Finke; R15009, 23 km N Koonibba Mission; R15195a-b, R15619, S of Scorpion Springs Conservation Park; R15954, Parachilna; R15958, Mt Serle; R16060, R17106, Danggali Conservation Park; R16176, abandoned piggery, W Bordertown-Pinaroo rd; R16205, Mt Hack, 38 km E Beltana; R16212, Depot Creek Gorge; R16227, Ninety Mile Desert; R16521, Gum Creek, Corunna Hills; R16522a-b, nr Millalee Creek, N Port Lincoln; R16650, 'Bibliando'; R16765, R16844, R17845, R17860a-c, R23233, R24184-86, Uro Bluff; R17144, Pinkawilline Reserve; R19898-99, 'Koondoolka'; R22784, R23091-93, Mt Remarkable National Park, 2.1 km E Sugargum Lookout; R24298, 0.7 km SSW Old Siam H.S.; R24445, E end Brachina Gorge; R24865, nr 'Oraparinna' H.S.; R25071-73, Stoney Creek; R25349, Hambidge Conservation Park; R26333, 22 km NW Yalata Roadhouse; R26339, 20 km W Yalata Roadhouse; R26349, 50 km W Yalata Roadhouse; R28540, 77.5 km N Minnipa; R32127, 11 km SSW Maralinga; R32168, 8.5 km SW Maralinga; R32278, 50 km SW Hanilar Lake; R32498, Bascombe Well Conservation Park; R32894, Wanna; R32912, 3 km along Talia Caves rd from turnoff on Flinders Hwy; WAM R24528, 37 km ENE Wirrulla.

**South Australia (unpatterned north-eastern form):** AM R17622, Coober Pedy; SAM R12756a-b, 'Muloorina'; R14342, Margaret River, S of Lake Eyre; R17048, Coward Springs; R21015, Balta Baltana Hill; R22193, Hermit Hill; R25826, William Creek; R25857-58, Mt Dare; R28130, 'Stuart Creek'; R28138, W of Maree; R28172, Beresford Rail Siding; R28215, 'Dalhousie' ruins; R28248-51, R28258-60, Abminga Rail Station; R29000, SW of Warrina; R30401, Breakaways Reserve, 25 km NNW Coober Pedy.

**Victoria:** AM R42724, Lowan Sanctuary, 20 mi. W Piangil; R54889, 15 mi. W. Annuello; R84294, R84297-98, Hattah.

**Western Australia:** AM R8778, Mt Barker; R11114, Woodlands, Tambellup; R101995, R102004, Hamelin Pool,

'Hamelin'; R102005, ca 21.4 km N 'Nerren Nerren' turnoff via North-West Coastal Hwy; R105720, 34.7 km N Tamala turnoff on Denham rd; R105740, 3.2 km S Nanga turnoff on Denham rd; R105813-15, 45.1 km W Newman Rocks turnoff on Eyre Hwy; R105879, 39.8 km E Cocklebiddy Roadhouse on Eyre Hwy; R117736, west side Boulder; BMNH 1904.10.7.18, Coolgardie district.

***Delma borea* Kluge, 1974: 81.**

**Diagnosis**

A small to moderate-sized species of *Delma* (maximum SVL 98 mm; Storr *et al.* 1990) with two pairs of supranasals, fourth supralabial usually subocular, modally 16 midbody scales and, in juveniles and subadults at least, a dark head dorsally and laterally, with narrow pale bands (one preocular, one postocular, one auricular, usually forked laterally, one branch running along each edge of ear, and one nuchal), but mid-throat region immaculate, pale.

**Description**

See Kluge (1974) and Storr *et al.* (1990).

**Distribution**

In the Northern Territory, most common in the Top End, north of 'Wave Hill', 'Helen Springs' and 50 km S MacArthur River camp, and including Groote Eylandt, Bathurst I., Cape Wessel I., Melville I. and Vanderlin I. (Fig. 2). The few records from further south (Alice Springs, Arltunga ruins, Ayers Rock, Barrow Creek, George Gill Range, Heavitree Gap, Kintore Range, Mt Doreen) are generally from rocky areas.

Also occurs in Western Australia (Kimberley and its southern fringe, eastern Pilbara, Barrow I., Hermite I., Rosemary I. and Warburton Range) and western Queensland (Storr *et al.* 1990; Shea 1987a).

**Habitat**

Kluge (1974) stated that *D. borea* was most frequently encountered in regions of stony, hard soil and *Triodia*, but that it did not appear to occupy *Triodia* on sandplains. However, most specimens collected from the Northern Territory are from savanna woodland lacking *Triodia*. Around Darwin, in particular, the species seems to be abundant, sheltering under debris and leaf litter. The 40 specimens from the Top End for which microhabitat data are available were found in or under leaf litter, grass, exfoliated bark, logs and rubbish (tin, cement slabs, compost and boards). However, the two Heavitree Gap specimens from further south were found under rocks beneath *Triodia* tussocks on a steep hillslope.

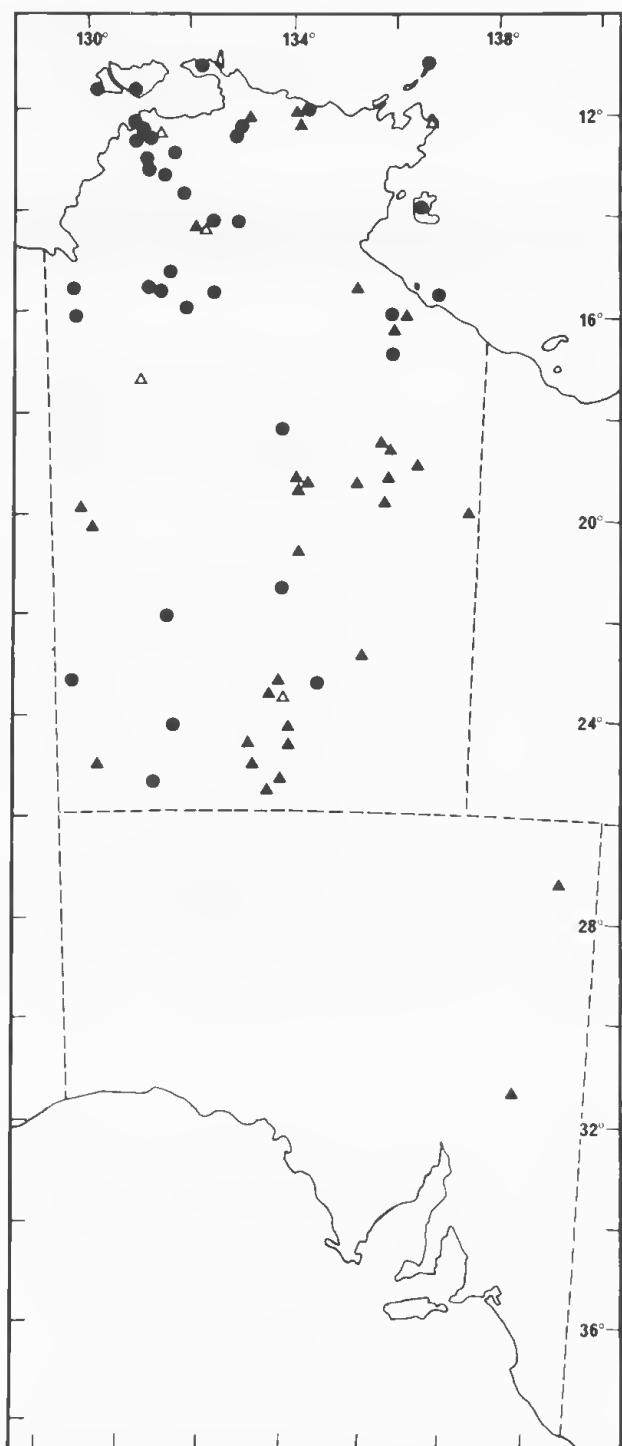


FIGURE 2. Distribution of *Delma borea* (dots) and *D. tincta* (closed triangles) in the Northern Territory and South Australia. Open triangles represent localities of sympatry or near sympatry.

**Remarks**

*Delma borea*, *D. tincta* and *D. pax* have very similar colour patterns, and largely replace each other geographically. They appear to comprise a species group, the *D. tincta* group, diagnosable by the usual presence of only a single clongate upper

temporal scale bordering the parietals, a character otherwise common in *Delma* only in *D. plebeia* (frequency: *D. borea*, 93.8%, n = 65; *D. pax*, 96.5%, n = 57; *D. tincta*, 97.4%, n = 115; *D. plebeia*, 76.9%, n = 13). Within the *D. tincta* group, three scalation characters separate the species. *D. borea* typically has two pairs of supranasals, fourth supralabial below eye, and 16 midbody scales; *D. tincta* typically has one pair of supranasals, third supralabial below eye, and 14 midbody scales, while *D. pax* is intermediate in having two pairs of supranasals, third supralabial below eye, and 16 midbody scales. However, occasional specimens show different combinations of these three characters, and proved difficult to assign to species. The problem seemed most acute in the case of *D. borea/D. pax*, which differed only in the number of the subocular supralabial, and as initially described were widely separated geographically (Kluge 1974), but had both recently been recorded from the Pilbara (Storr *et al.* 1990). Examination of all material of *D. pax* in the WAM collection revealed that the two taxa may additionally be differentiated by several subtle coloration differences. In *D. pax*, the pale postocular band broadens ventrally (even width or only slightly broader ventrally in *D. borea*), the auricular band is often broader laterally, and there is no ventrolateral series of parallel pale streaks along neck and forebody (usually present in *D. borea*). On the basis of these additional characters, *D. pax* appears to replace *D. borea* in the western Pilbara and along the north-west coast north to 'Anna Plains', while *D. borea* is largely confined to the Kimberley, south to East Palm Spring in the Denison Range, with populations on several islands (Barrow, Rosemary, Hermite) off the Pilbara coast, and one record (WAM R25201, 32 km E Jiggalong) from the eastern Pilbara.

The identity of the single Ayers Rock specimen (CAWC R1319) is problematic. The colour pattern is similar to typical *D. borea*, but although the specimen is of adult size (SVL 86.5 mm), the head is black with narrow white bands. Such intensity of pattern is rare in adult *D. borea* and *D. tincta*, and has not been seen in *D. pax*. The specimen has two pairs of supranasal scales and 16 midbody scales, typical of *D. borea*, but the third supralabial is subocular, typical of *D. tincta* and *D. pax*. Until further material becomes available, I refer this specimen to *D. borea*, on the basis of the number of supranasal and midbody scales.

#### *Specimens examined*

**Northern Territory:** AM R3662, R4162, R62673, QM J1781, Port Darwin; AM R8249, R12877, R14161, R19121, R38021, R127980, R128741, CAWC R9, R1680, R4582, R3080, NTM R9930-31, WAM R21980, R40296, R40835,

Darwin; AM R12794, R12841, R13004, Darwin area; R12901, Westhead, Darwin; R13471, R13609, CAWC R4950, NTM R7456, Groote Eylandt; AM R13569-70, R13648, R62670-72, Cape Arnhem; R13713, R13777, WAM R23480, Nightcliff, Darwin; AM R14336, NT; R30014-15, R107502, Black Point, Port Essington; R52135-36, Heavitree Gap, Alice Springs; R52137, Adelaide River township; R53149, Mt Doreen; R54745, ca 50 km S McArthur River camp; R54746, 30 km N McArthur River camp; R55904, Vanderlin 1.; R61573, Maningrida; R73069, R76043, Bullo River Stn rd, 31 km NW Victoria Hwy; R75511, midreaches McKinlay River; R80369, 25 km S Larrimah on Stuart Hwy; R88876, Jabiluka project area; R98442, vicinity of 009 Gauge Stn, Magela Creek drainage; R112829, Mindil Beach Casino site; BMNH 1932.3.7.25, 'central Australia'; 1973.3285, Kintore Range (23°21'S 129°23'E) (formerly JSE 269); CAWC R1318, R1320, Arltunga ruins; R1319, Ayers Rock; R5511, Beatrice Hill; MV D174, Alice Springs; NTM R159, Riverview Caravan Park; R173-174, Pine Creek; R1040, Maclear Creek, S side Melville I.; R1317, R5371, Barrow Creek; R1779, SAM R8409, Katherine; NTM R1947-51, Millner School grounds; R2045, Mt Carr; R2082, Winellie; R2108-09, R3051, Rapid Creek; R2429, R2507-08, R3053, Millner; R2954, R3052, R8705, Stuart Park; R3144, R3146, R3194-97, R3218-21, R7593-98, Ban Ban Spring; R3299, Berry Springs; R3411, Allawa; R3791, Katherine district; R3870, Jabiru tip; R5825, R6516-17, R6609-10, Wave Hill; R6594, 70 km N Top Springs; R7744, Cape Wessel 1.; R7883, R7946, Cape Fourcroy, Bathurst I.; R8120, the 17 mile, S of Darwin; R8306, 2 km W Victoria River bridge on Victoria Hwy; R8340, Ludmilla; R9133, Keep River National Park; R9457, 20 km N Mataranka; R9467, 110 km W Katherine; R9494, Bees Creek, nr Darwin; R9496, Fannie Bay; R11696, R12956, Katherine Gorge National Park; R12727, George Gill Range; R13221, Humpty Doo; R13237, Gregory National Park; QM J39334, Cahills Crossing, East Alligator River; WAM R13496, R34331-32, Yirrkala; R24198, Helen Springs; R24001, 11 km N Adelaide River; R26224, Parap.

**Queensland:** AM R26138-39, R28445, R107000, Mt Isa; R31627, R31629-30, Mt Isa district; R60248, 3 km W Cloncurry on Flinders Hwy; R63589, Bang Bang jumpup on Hwy 83; R90212, Inca Creek; R110534, Scotts Tank, 'Diamantina Lakes'; R110601, 6 km E Scotts Tank, 'Diamantina Lakes'.

**Western Australia:** AM R14160, Forrest River Mission; R40518-19, junction Ord and Behn Rivers; R49970, Balgo Mission; R56822, Halls Creek; R117604, vicinity of Cape Lefeque; R126188, Mitchell Plateau airstrip; BMNH 1966.415, Wooroloo [in error]; NTM R7286-87, 167 km E Fitzroy Crossing; R13047, 3 mi. S main Ord River Dam site; SAM R5058, Warburton Range; WAM R11240, Wotjulum; R25201, 32 km E Jiggalong; R28656, Barrow 1.; R37371, Rosemary 1.; R37406, Hermite 1.; R37703, Hidden Valley; R43075, Crystal Creek near Crystal Head; R44566, mouth of Behn River, Lake Argyle; R44575, 2-3 mi. upstream Ord River from Behn River junction; R48559, nr Shark Point, Barrow Island; R60352, 3 km E Nicholson; R70564, 5.2 km 202° Mt Percy; R75533, 11 km WNW New Lissadell H.S.; R94881, Lake Argyle; R96944, north-west hump of the Dromedaries; R99776, 10 km SW Silent Grove.

**No data:** AM R55613-14, BMNH 1946.8.26.99, NTM R3558, R5811.

***Delma butleri* Storr, 1987: 346.**

**Diagnosis**

A moderate-sized relatively inornate species of *Delma* (maximum SVL 96 mm) with two pairs of supranasal scales, the caudal pair contacting or only narrowly separated from the nostril, modally 16 midbody scales and fourth supralabial subocular, usually four loreals, snout short (Fig. 3), and venter without dark markings.

**Description**

See Storr (1987) (as both *D. butleri* and *D. haroldi*) and Shea (1987b) (as *D. nasuta*).

**Distribution**

Extreme south of Northern Territory (Alice Springs and vicinity of Uluru National Park) and the adjacent far north-west corner of South

Australia, and arid southern South Australia, south of 43 km NE Maralinga, Mt Finke, 118 km NE Minnipa, Uro Bluff, Parachilna, Paralana Hot Springs and Danggali Conservation Park, with a possible north-eastern isolate near the South Australian/Queensland border (Figure 4). Also occurs in the arid parts of W.A. (Storr 1987, as *D. butleri* and *D. haroldi*) and south-western N.S.W. and north-western Victoria (Shea 1987b, as *D. nasuta*). An early record from St Francis I. (BMNH 1922.11.8.8-10) has not been confirmed by recent collections from that island and must be treated as suspect.

**Remarks**

Storr (1987) separated this species from *D. nasuta*, but referred to it only material from Western Australia and western South Australia. This distribution was followed by Wilson & Knowles

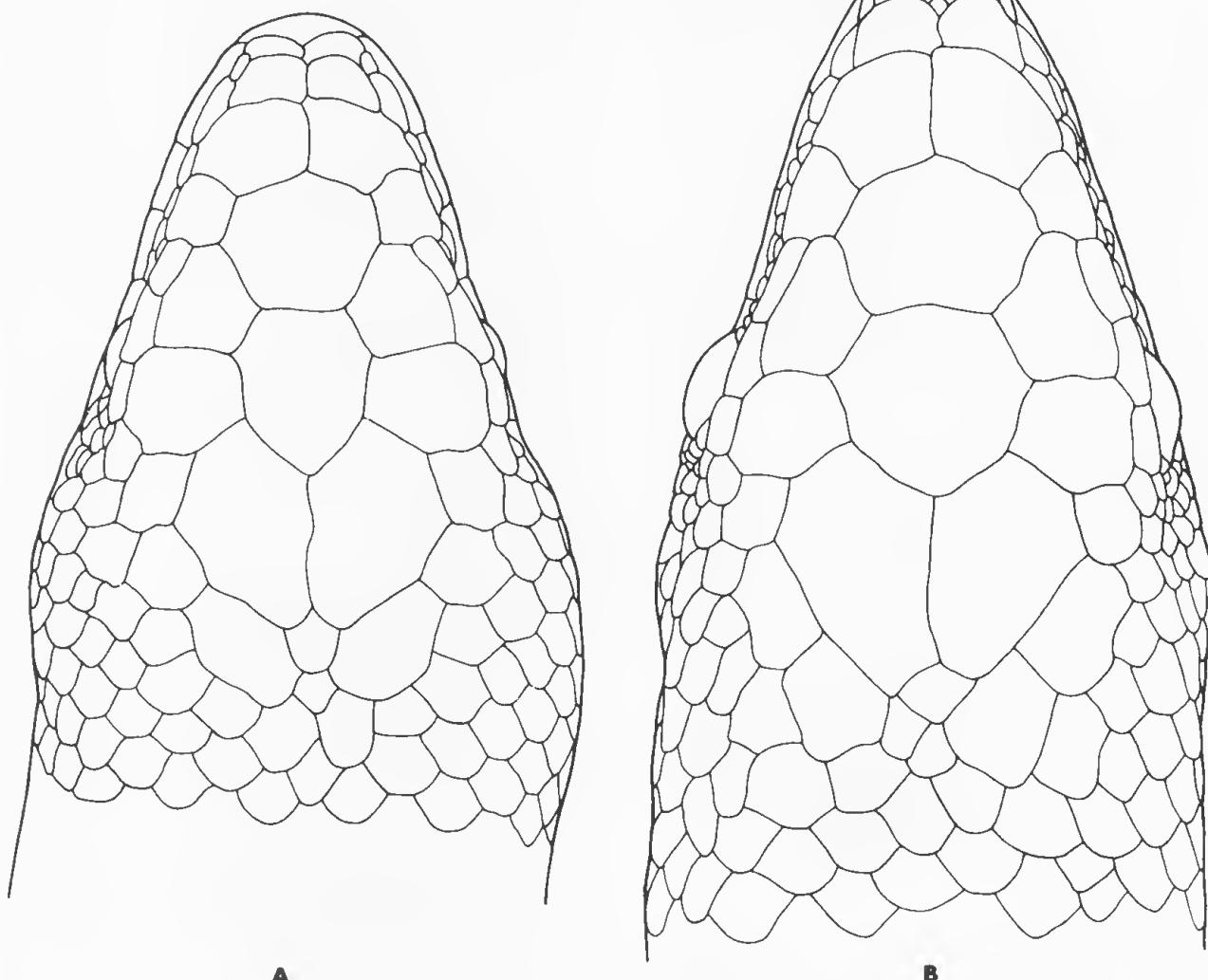


FIGURE 3. Dorsal view of heads of A. *Delma butleri* (AM R44362) and B. *D. nasuta* (AM R17376).

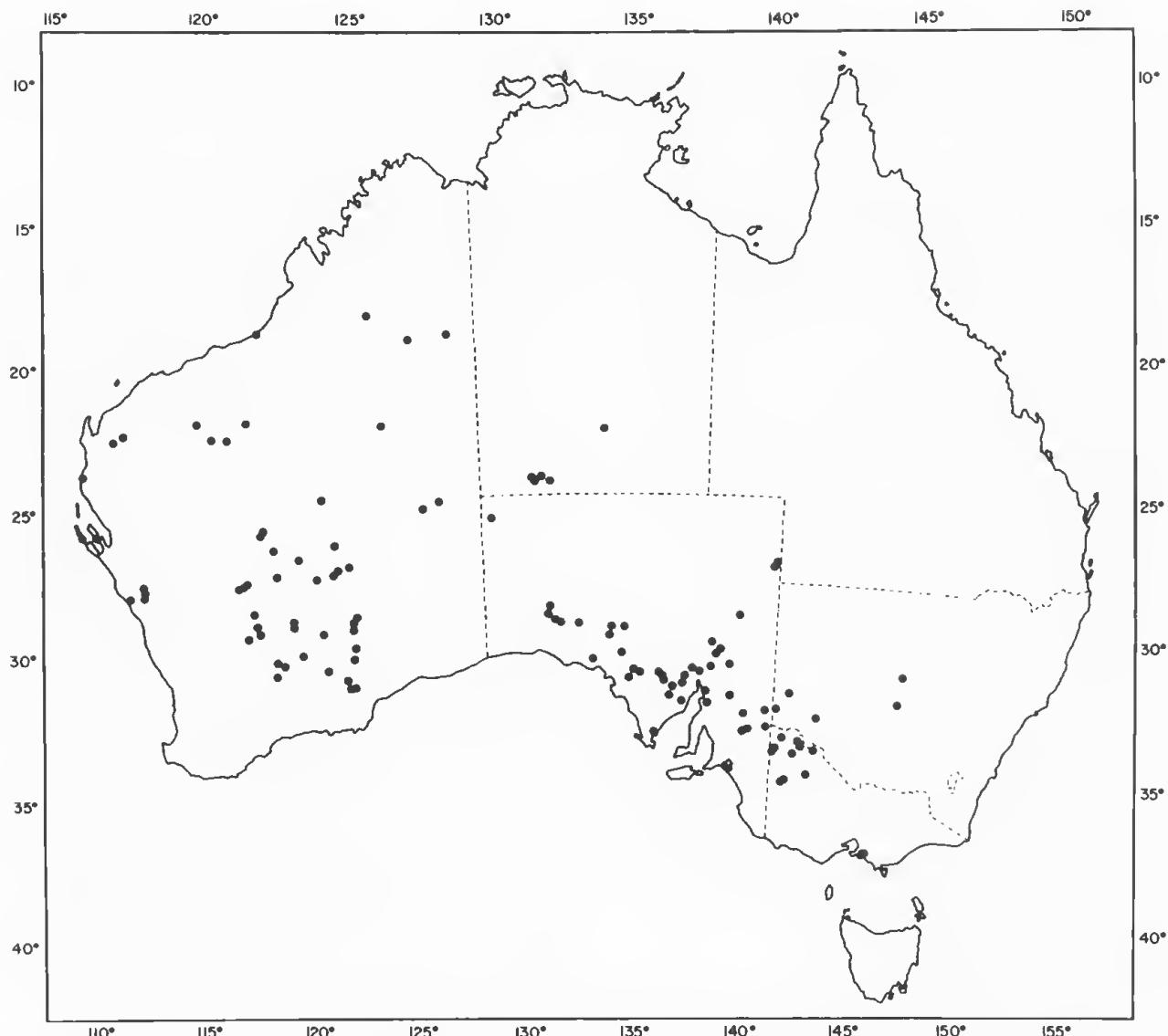


FIGURE 4. Distribution of *Delma butleri*.

(1988). However, comparison with the type series of *D. butleri* indicates that all southern populations referred to *D. nasuta* by Kluge (1974) and Shea (1987a) are *D. butleri*. To the recorded instances of sympatry between *D. butleri* and *D. nasuta* can be added SAM R12674 (*D. butleri*) and R12675 (*D. nasuta*) both from Warburton Range.

In describing *D. haroldi*, Storr (1987) only compared it with *D. borea*, to which species the type series had previously been identified. However, *D. haroldi* consistently has two or more upper temporal scales and cannot be placed in the *D. tincta* species group with *D. borea*. When the descriptions of *D. haroldi* and *D. butleri* are compared, it becomes evident that there are very few, if any, differences between these two taxa. The populations of *D. butleri* geographically closest to *D. haroldi*, in the

Pilbara, are also the most similar in coloration, with well developed pale bars laterally on the face and neck. Significantly, these populations have two additional pale bars between the pale postocular and auricular bars, a character otherwise seen only in *D. haroldi*. Specimens identified as *D. butleri* (WAM R94585) and *D. haroldi* (WAM R64715; fig. 3 in Storr 1987) both from the vicinity of Marandoo, W.A. are almost identical, and clearly conspecific, as is another specimen (WAM R53760) from the same locality, and the specimen of *D. haroldi* (WAM R63632) from 19.5 km SE of Mt Meharry. Of the remaining types of *D. haroldi*, the seven specimens from the Kimberley, adjacent parts of the Eastern Division, and the Pilbara coastal lowlands (WAM R46043, R64703, R63427, R45243, R45811, R51722, R85094) have only a single pale

temporal band between postocular and auricular bands. However, the paratype (WAM R73630) from Ophthalmia Range, geographically intermediate between the Marandoo and Eastern Division material, has an intermediate condition, with one pale temporal band on one side forking into two bars on the other. Seven specimens from central Australia (AM R14362, R96116, CAWC R1321, R1323, R1636; SAM R29900, R29935) are variable in this character, some having one band, others showing division of this band ventrally. Because of this wide zone of apparent intermediates, apparently an extension of the south-east to north-west gradation in the development and intensity of facial markings previously noted within *D. butleri* (Storr 1987), I synonymise *D. haroldi* and *D. butleri*. As both were described in the same publication, I nominate *D. butleri* (which has page priority) to have priority over *D. haroldi*. Whether the typical '*haroldi*' from the extreme north and north-west of the distribution can be recognised at a subspecies level awaits the collection of further material from the intervening areas.

Variation in *D. butleri* throughout the southern part of its range is minimal. Live material I have examined from 23 km ENE of Yuna, W.A. in the west of the distribution was similar to material from 23 km ENE of Kimba, S.A., and the N.S.W. material illustrated by Shea (1987b). Most of this material had only very slight development of pale facial markings, reduced to 1-2 lip bars preocularly and 2 lip bars postocularly.

The five specimens from Dirk Hartog Island differ from mainland populations in being noticeably more bulky and having 17 nuchal scales (vs 15-17, usually 15 for other North West Division material), more broken pale markings of reduced contrast, but with dark edges, a dark apical spot on each dorsal body scale, and a lighter brown dorsal ground.

#### Habitat

Like populations in W.A. (Storr 1987) and N.S.W. and Victoria (Shea 1987b), S.A. and N.T. populations are *Triodia* inhabitants. All 48 specimens for which field data are available were either taken from live or dead *Triodia* clumps or from habitats noted to contain *Triodia*. The substrate, where noted, ranged from sand dunes to rocky hillslopes, and the overstory at various localities included mallee eucalypts, *Casuarina*, *Melaleuca* and *Heterodendron*.

#### Specimens examined

**New South Wales:** see Shea (1987b).

**Northern Territory:** AM R14362, road, 'Curtin Springs' to Ayers Rock; CAWC R1321, R1323, Ayers Rock; R1636, Uluru National Park, 15 km S on Britten Jones track;

R4808, Alice Springs; SAM R29900, R29935, 24 km along 'Mulga Park' road, SSE 'Curtin Springs'.

**South Australia:** AM R7649, Immarna; R105536-37, 23.0 km ENE Kimba; R115906-08, Pandappa Hill; BMNH 1922.11.8.8-10, St Francis I.; MV D2659, W of Kychering Soak, No. 3, Overland Railway to WA on line of march; D15453-54, Renmark; NTM R9212, SAM R13919, R17716, Immarna; NTM R9295-96, SAM R16283, 'Canopus'; SAM R54, Waikerie; R3066a-b, Birthday Well, 'Cariewerloo'; R3067, 'Coralbignie'; R3851a-d, 15 mi. N Poochera; R3878a-c, Wilson; R5022a-c, West Coast; R5376a-c, Gawler Range; R10727-28, Mamblin; R10932, Paralana Hot Springs; R12450-51, R14687, R14696, Corunna Hills; R13041, 'Hiltaba' H.S.; R14020, Baroota Reserve; R14225, Childara Rockholes; R14463, Mambray Creek National Park; R14568, Lincoln Way, 48 km SW Whyalla; R17338, 21 km E Blanchetown; R19900-01, nr Chinaman Dam, 'Yardea'; R14913, 'Baratta'; R14964, Mt Finke; R14982, 22 km E Barton Rail Station; R15353, Uno Range; R15955, Parachilna; R16211, Depot Creek Gorge, 34 km NNE Port Augusta; R16523, nr Millalee Creek, N Port Lincoln; R16524, Gum Creek, Corunna Hills; R16649, 'Bibliando'; R16755, Wilgena Hill; R16843a-b, R17844a-b, R17871, R23767, R24134, R24158-59, R24163, Uro Bluff; R17120, R17659a-b, Danggali Conservation Park; R17681, 'Balah'; R17984, R18002, Lake Gilles Conservation Park; R18121a-c, S of 'Hypurna'; R18763-64, 1 km NNE Iron Duke; R18768, 1 km W Iron Duke; R17458, Wilpenna Motel; R22301, 2 km E Ooldea; R24297, S of 'Kolendo' H.S.; R24863, nr 'Oraparinna' H.S.; R25515-17, R25535, R25731, Danggali Conservation Park nr 'Canopus'; R28495, 118 km NE Minnipa; R28568, 73 km N Minnipa; R29090, Bowman Park Reserve; R31361-62, Iron Duke; R31949, S Inila Rock Waters; R32137, 9.7 km SSW Maralinga; R33795, 12 km SSE Dulingari Oil and Gas Satellite; R33803, Toolachie Gas Satellite; WAM R36649, 43 km NE Maralinga; R44362, 34 mi. NW Mt Lindsay, Birksgate Range.

**Victoria:** see Shea (1987b).

**Western Australia:** AM R86501-02, 2.5 km SW Condun Well; R96116, 150 km SW Giles Meteorological Station on road to Warburton; R105791, 36.1 km N Widgiemooltha Roadhouse on Coolgardie Hwy; SAM R12674, Warburton Range; WAM R18551, Queen Victoria Spring; R21073, 33 km W Carnegie; R26503, 35 km NE Yuna; R28359, 16 km N Ethel Creek; R45243, 28 mi. N Windy Corner; R45811, Wallal; R45850, 8 mi. S of H.S., Dirk Hartog I.; R46043, 91 mi. E McLarty Hills; R47709, Northampton; R48184-88, R48261, R48270, East Yuna Nature Reserve, 30 km SE Yuna; R51722, 2 km SW Barradale; R53255-56, Ivor Rocks; R53277, 75 km N Kalgoorlie; R53291, 27 km NE 'White Cliffs' H.S.; R53459-60, Newman Rock; R53760, R94585, Mt Bruce, Marandoo; R54556, 25 km S Denham; R57087-88, R57093, 3 km N Cape Ransonnet, Dirk Hartog I.; R57094, 5 km N Cape Ransonnet, Dirk Hartog I.; R57522, 40 km NE Yuna; R57541, 44 km NE Yuna; R57959, R58072, 4 km E Boingaring Rocks; R59854-55, 17 km N Charlina Rock; R62822, 22 km SE Mt Keith; R63427, Twin Heads; R63632, 19.5 km SE Mt Meharry; R64703, Balgo Mission; R64715, Marandoo; R64754-55, Mt Manning Range; R64794, R64813-14, Blue Hill, Lake Barlee; R65367, R65463, R65484, 30 km NW Heartbreak Ridge; R65531, R65569-70, R65654, R72503, R74557, R74597, 3.5 km SW Buningonia Spring; R65539, R65590, R74591, 1.5 km SE

Buningonia Spring; R67188, 15 km NE Bungabbin Hill; R67974, Ramona Well, 35 km 164° Dandaraga; R69080, R69104, R74658, 8.7 km ENE 'Yuinmery' H.S.; R69108, 8.0 km ENE 'Yuinmery' H.S.; R69288, 12.5 km SSE 'Banjiwarn' H.S.; R70876-77, 2 km N Mt Windarra; R70893, 1 km 45° Yowie Rockhole; R71775, 32.5 km 182° Woolgangie rail siding; R72248, R72255-56, R72285-86, R72291, nr Boorabbin; R72537, 3.0 km SW Buningonia Spring; R72669, 2.5 km NE Comet Vale; R72728, 3.5 km NE Comet Vale; R73212, R73228-29, 6 km 78° Yowie Rockhole; R73630, Ophthalmia Range area; R74677, R74679, 24 km ENE 'Yuinmery'; R74784, 9.5 km SSE Banjiwarn; R75559, East Yuna Nature Reserve; R76121, 16 km SSW Mt Jackson Hill; R76645, 3 km SE 'Gnaraloo' H.S.; R76742, 5 km SE 'Gnaraloo' H.S.; R78548, 30 km SSE Mt Keith; R78553, 29 km SE Mt Keith; R78680, 5 km W Mt Manning Range (S.E. Peak); R78688, 4 km W Mt Manning Range (S.E. Peak); R78689, 12 km W Mt Manning Range (S.E. Peak); R85094, 11 km NNW 'Uaroo' H.S.; R85305, 4 km ESE Big Shot Bore; R85600-01, R85603-04, 39 km E Laverton; R85605-06, 8 km WNW Pt Salvation; R86658, 37 km S Agnew; R90291, 9 km ENE 'Yuinmery' H.S.; R91510, 4 km E Zanthus; R94077, 53 km NNE Queen Victoria Spring; R97262, Queen Victoria Spring National Park; R97303, 23 km ENE Yuna; R99603, R99759, Mt Lawrence Wells; R99654, 9 km NNE Mt Lawrence Wells.

No data: BMNH 1966.5.

#### *Delma fraseri* Gray, 1831a: 14.

##### i. The identity of *Delma fraseri*

*Delma fraseri* was described by Gray in two works published in the same year (Gray 1831a,b). Kluge (1974) discussed the priority of these two works, and considered Gray (1831a) to be the earlier description. This conclusion was later followed by Cogger *et al.* (1983). Gray (1831a) did not state the number of specimens on which he based his description, although the single set of measurements and lack of any variation suggest that only a single specimen was before him at the time. At least one specimen was in the British Museum collection (Gray 1831b). Ten years later, Gray (1841) provided an illustration of *D. fraseri*. Still later, in his catalogue of the lizards in the British Museum, Gray (1845) lists two specimens, one adult from Western Australia presented by James Hunter (presumably the type) and a half-grown specimen from Western Australia from Gilbert's collection (presumably the naturalist John Gilbert). Boulenger (1885) in the second catalogue of British Museum lizards, lists two halfgrown syntypes, both from 'W. Australia', presented by J. Hunter, but no Gilbert specimen.

In restricting the name *D. fraseri* to a south-western species, Kluge (1974) used three characters from Gray's (1831a) description (two pairs of supranasals [presumably based on Gray's description of 'head . . . covered with four pair and three odd central plates'], three preanals, and

banded head and neck) and two characters from Gray's (1841) illustration (dark throat markings, and fourth supralabial in subocular position), but did not examine the purported syntypes.

I have examined both specimens (now BMNH 1946.8.26.98-99). The former specimen is clearly that illustrated by Gray (1841), although the illustration is reversed. This juvenile specimen is conspecific with *Delma fraseri* (*sensu* Kluge). However, it is not the specimen measured by Gray (1831a), having SVL 52 mm and tail length 135 mm (vs '2 inches, 8 lines' [= 68 mm] and '3 inches 8 lines' [= 93 mm]). The second specimen, almost broken at midbody, has more similar but slightly greater measurements (SVL 71 mm; tail length 97 mm) to those given by Gray (1831a). This specimen, however, is conspecific with *D. borea* Kluge, 1974. No other *Delma* specimen currently in the British Museum (Natural History) is of suitable age to be a potential type.

The morphological characters provided by Gray (1831a) apply equally to *D. borea* and *D. fraseri* (*sensu* Kluge), as well as to several other *Delma* species. The description of the head and neck markings is ambiguous, and different interpretations could fit either species.

Gray's (1831a) description reads (in part): 'head and lips black, with four narrow cross lines, one between the nostril and the eyes, two just behind the eyes, the third broader over the eyes, and the last edging the occiput'. Presumably the 'four narrow cross lines' are pale bands on the black ground (Gray 1831b). Both *D. borea* and *D. fraseri* (*sensu* Kluge) have a preocular band ('between the nostril and the eyes' and presumably the first of the four cross-lines). If 'two just behind the eyes' is interpreted as a dorsally broken postocular band, the description fits *D. fraseri* (*sensu* Kluge), not *D. borea*, which has a complete postocular band. However, the position of the third band is then difficult to interpret. If 'two just behind the eyes' is interpreted as the successive second and third bands, these must be complete postocular and auricular bands, and the last band must be the pale edging to the dark nape patch, agreeing with *D. borea* and not *D. fraseri* (*sensu* Kluge), although the third band is again problematic, over the ears, not the eyes.

The 'discoverer' of *D. fraseri*, James Hunter, may be the James Hunter who was one of the naturalists on P. P. King's 1818-1822 survey of the Australian coast. This voyage visited both the south-west and north coasts of the continent, and could equally have collected either species. John Gilbert, the other collector later listed by Gray (1845), also visited both areas.

As the original description does not allow definite identification of the species, and as the type status

of neither purported 'syntype' is clear (neither accurately fits the single set of measurements, and their registration history has varied), I act to conserve the usage of Kluge (1974) and all subsequent authors by designating BMNH 1946.8.26.98, the specimen illustrated by Gray (1841), as neotype of *Delma fraseri* Gray, 1831a. This specimen has the following combination of characters: two pairs of supranasals, seven supralabials (fourth subocular), 7/6 infralabials, 5/4 loreals, 4/5 suboculars, two upper temporals, 15 nuchal scales, 14 gular scales, 16 midbody scales, three preanal scales and 73 ventral scales (caudal 56 transversely enlarged).

## ii. A new subspecies of *Delma fraseri*

Kluge (1974) identified three South Australian specimens as *D. fraseri*, otherwise only known from south-western Western Australia, but did not note any significant differences between two of the eastern specimens and the western population. However, additional material of the eastern population now in hand has shown consistent differences between the two populations in number of midbody scales and strength of the throat markings, and extended the known range of the eastern form into Western Australia. Consequently, the eastern form is here given subspecific status.

### *Delma fraseri petersoni* subsp. nov.

Figs 5-7

Holotype: SAM R20804, N end stock route (32°51'S 135°57'E), S.A., Nature Conservation Society, 13.x.81

Paratypes (11): SAM R3853, 15 mi. N Poochera, S.A., F. J. Mitchell, 15.vi.56; R10586, same locality, F. J. Mitchell, vi.56; R14985, 7 km W Immarna rail siding, S.A., C. and T. Houston, A. Edwards, J. Herridge, 7-9.xi.75; R20790, 2.5 km down stock route (32°53'S 135°57'E), S.A., Nature Conservation Society, 8.x.81; R20816, N end stock route (32°51'S 135°57'E), S.A., Nature Conservation Society, 11.x.81; R32259, Scrubby Peak area, S.A., G. Armstrong, 22.i.88; R32463, Middleback Ranges, S.A., South Australian Herpetology Group, 26.vi.87; R33681, Iron Duke, Middleback Ranges, S.A., G. Johnston, xi.81; WAM R100636, 20 km NNE Queen Victoria Spring, W.A., D. Pearson, 18.vi.87; R100930, 25 km NNE Queen Victoria Spring, W.A., D. Pearson, 21.i.89; R100964, Jumpbuck Rd, Plumridge Lakes, W.A., D. J. Pearson, 17.x.86.

### Diagnosis

A large *Delma* (SVL up to 128.5 mm) differing from all other *Delma* in the combination of two

pairs of supranasal scales, a dark head dorsally and laterally followed by a broad, dark nape patch (both reduced in intensity in adults), broad dark throat bands, a mode of 18 midbody scales, and 67-78 ventral scales.

### Description

Rostral broadly projecting between rostral supranasals, apex gabled; rostral supranasal in broad contact with first supralabial; caudal supranasals present, in point to moderate contact with nostril; postnasal distinct, single; loreals 3-5 ( $\bar{x} = 4.1$ , SD = 0.45, n = 24), usually 4 (79%), in single, unbroken series; preoculars 6-13 ( $\bar{x} = 8.3$ , SD = 1.82, n = 23); suboculars 3-5 ( $\bar{x} = 3.7$ , SD = 0.58, n = 21), usually subequal; supraciliaries 5-7 ( $\bar{x} = 5.3$ , SD = 0.55, n = 24), usually 5 (75%), caudalmost large, medial to others; supraoculars two, first longer; supralabials usually 7 bilaterally with fourth below centre of eye (n = 11), rarely 8 unilaterally with fifth below centre of eye (n = 1); infralabials 6-9 ( $\bar{x} = 7.0$ , SD = 0.62, n = 24), usually 7 (75%), first pair in contact on ventral midline, second pair separated; upper temporals two; occipital present, single; nuchal scales 15-17 ( $\bar{x} = 15.8$ , SD = 0.72, n = 12); gular scales 15-18 ( $\bar{x} = 16.7$ , SD = 0.98, n = 12).

Midbody scales usually 18 (n = 11), rarely 17 (n = 1); ventral scales 67-78 ( $\bar{x} = 72.0$ , SD = 3.30, n = 12), cranial 14-18 ( $\bar{x} = 15.9$ , SD = 1.24, n = 12) small, caudal 52-61 ( $\bar{x} = 56.1$ , SD = 2.68, n = 12) transversely enlarged; preanal scales three; hindlimb scales 2-4 ( $\bar{x} = 3.3$ , SD = 0.61, n = 24).

Snout-vent length 78-128.5 mm; tail length 264-317% of SVL (n = 4); hindlimb length 2.5-4.0% of SVL ( $\bar{x} = 3.1$ , n = 12); head length (HL) 10.1-13.2% of SVL (n = 12), proportionally shorter in adults; head width 57.0-70.7% of HL ( $\bar{x} = 64.6\%$ , n = 12); head depth 42.0-55.3% of HL ( $\bar{x} = 49.5\%$ , n = 12); mouth length 81.4-89.1% of HL ( $\bar{x} = 85.6\%$ , n = 12); snout length 38.4-44.6% of HL ( $\bar{x} = 40.1\%$ , n = 12); eye diameter 11.5-14.3% of HL ( $\bar{x} = 13.1\%$ , n = 11); postorbital length 38.0-43.4% of HL ( $\bar{x} = 41.1\%$ , n = 11); rostral depth 11.4-14.3% of HL ( $\bar{x} = 12.8\%$ , n = 12); rostral width 20.2-24.4% of HL ( $\bar{x} = 21.9\%$ , n = 12); dorsal rostral length 6.9-9.6% of HL ( $\bar{x} = 8.1\%$ , n = 12); ventral rostral length 8.9-14.0% of HL ( $\bar{x} = 10.4\%$ , n = 12).

The holotype has the following combination of character states: caudal supranasal narrowly contacting nostril; four loreals; 8/7 preoculars, four suboculars, seven infralabials, 17 nuchals, 16 gulars, 67 ventrals (caudal 52 dilated), SVL 85 mm, TL 269 mm, HLL 2.7 mm, HL 11.2 mm, HW 7.2 mm, HD 5.1 mm.

*Coloration (in preservative)*

Body dorsally and laterally light grey-brown, often with slightly darker centres and lighter margins to scales, producing a series of narrow alternating light and dark stripes. Tail dorsum concolorous with body basally, yellow-brown distally. Head dorsally darker grey-brown from tip of snout to just caudal to parietals, and laterally touching rostroventral angle of ear, the caudal margin generally marked by small, irregular black

patches. Dark hood followed by a light cream-brown or yellow-brown band, 3-4 scales wide, laterally crossing ear, in turn followed by a light to mid-grey nuchal band about 7-8 scales wide, touching caudodorsal angle of ear, with caudal edge convex, and cranial edge marked by small, irregular black patches. Body immediately caudal to dark nuchal band pale yellow-brown.

Dark cephalic hood invaded laterally by extensions of throat ground colour: an obscure

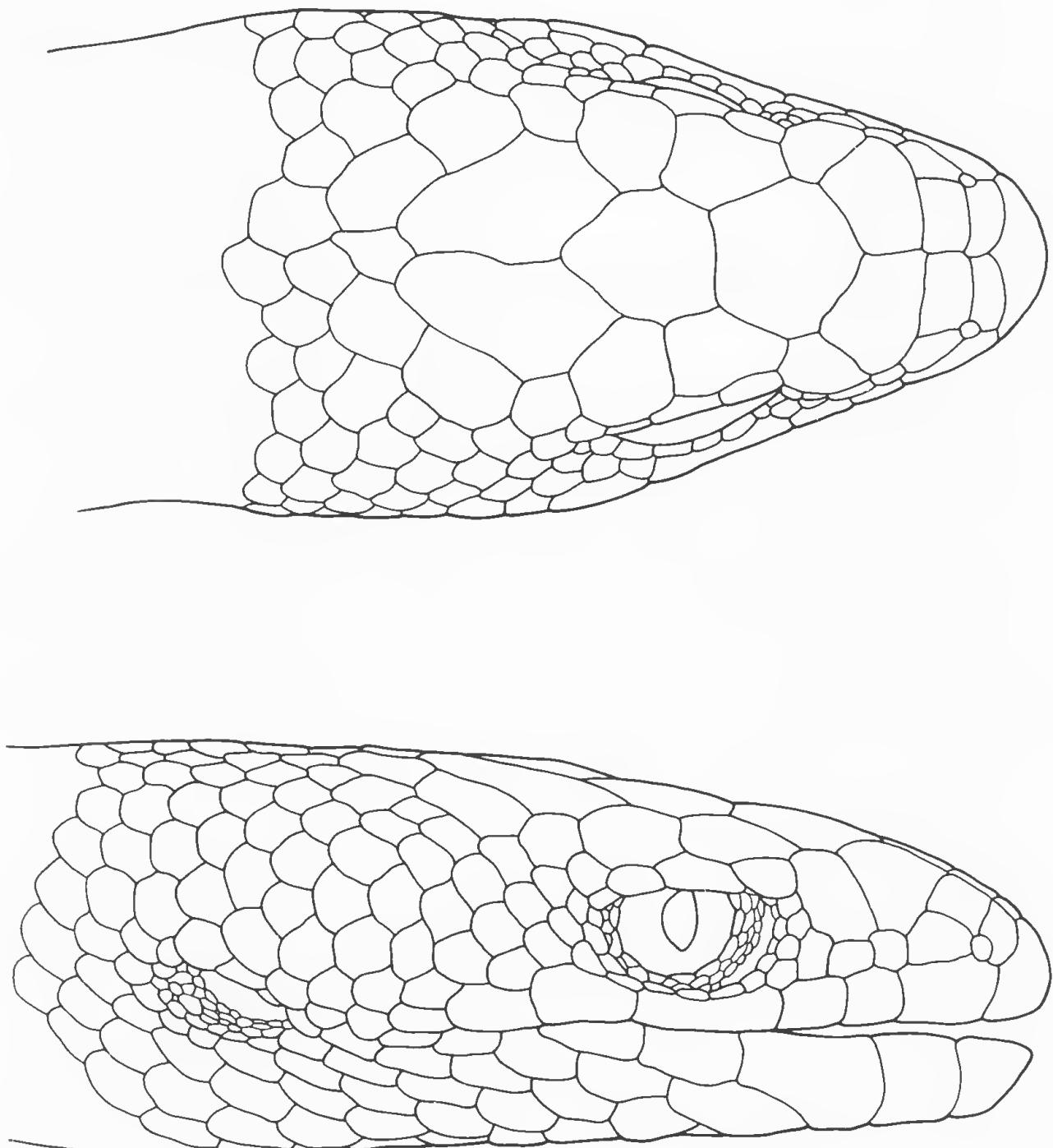


FIGURE 5. Dorsal and lateral views of head of holotype of *Delma fraseri petersoni*.

cream preocular bar and a broad triangular cream postocular bar. Laterally, dark nuchal band passes rostroventrally, narrowing ventrally, and is followed caudally by a broad triangular cream to orange-brown patch. Lateral ground on body and tail grades evenly into ventral ground.

Throat and chin cream, with dark grey bands, 2-3 scales wide, continuations of dark dorsal hood at level of orbit, rostral to level of ear, and caudal to level of ear, followed by one or two irregular bands not connected to dark dorsal markings. Dark bands often with irregular darker grey or black margins. First few infralabials usually with dark margins.

Body venter cream with grey margins to scales. Over caudal part of body and proximal part of tail, this grey perfusion almost completely covers the scales. Distal part of tail cream, generally immaculate.

Juveniles with similar pattern, but dark head markings solid black.

#### *Distribution*

Southern fringe of the Great Victoria Desert, and its extension eastwards to northern Eyre Peninsula and Middleback Range.

#### *Comparison with other taxa*

*Delma f. petersoni* differs from the nominate race in possessing a mode of 18 midbody scales (vs 16), and in having a strongly banded throat pattern. The throat pattern in adults of the nominate race consists of fine irregular dark variegations extending onto the throat from laterally (Fig. 6), unlike the broad complete bands of *D. f. petersoni*. Juvenile *D. f. fraseri* have stronger throat markings, often approaching those of adult *D. f. petersoni*, but the throat pattern of juvenile *D. f. petersoni* is even stronger, broad and evenly dark.

For comparative purposes, all material of the nominate race in the Australian Museum, British Museum (Natural History) and South Australian Museum was examined, together with Western Australian Museum material from the eastern extremity of the range. Comparative scale counts for this material in markedly variable characters were: loreals 3-6 ( $\bar{x} = 4.1$ , SD = 0.50, n = 140), usually 4 (78%); preoculars 3-9 ( $\bar{x} = 5.8$ , SD = 1.16, n = 136); suboculars 1-6 ( $\bar{x} = 3.4$ , SD = 0.68, n = 136); supralabials usually 7, with fourth subocular bilaterally (n = 68), rarely 6 with third unilaterally (n = 1) or 8 with fifth unilaterally (n = 1); infralabials 6-8 ( $\bar{x} = 7.0$ , SD = 0.44, n = 140); nuchals 12-17, ( $\bar{x} = 14.1$ , SD = 0.93, n = 70); gulars 14-18 ( $\bar{x} = 16.0$ , SD = 0.91, n = 70); ventrals 67-75 ( $\bar{x} = 71.1$ , SD = 2.09, n = 67); transversely enlarged ventrals 50-58 ( $\bar{x} = 54.5$ , SD = 1.91, n = 50); midbody scales 15 (n = 1), 16 (n = 66), 17 (n = 1) or 20 (n = 1).

The distance between the easternmost records of *D. f. fraseri* and westernmost records of *D. f. petersoni* is approximately 235 km. The two races appear to differ in habitat preference, *D. f. petersoni* inhabiting mallee-*Triodia* habitats (see below), while *D. f. fraseri* inhabits a variety of less arid habitats, including woodland, heath and coastal dune complexes (Bush 1981; Chapman & Dell 1977, 1978, 1980a,b, 1985; Dell & Chapman 1977, 1978; Dell & Harold 1977; Storr *et al.* 1981).

Only three other *Delma* have a mode of 18 midbody scales: *D. australis*, *D. elegans* and *D. molleri*. *D. f. petersoni* is very much larger than *D. australis* (maximum SVL 128.5 mm vs 88 mm), and has two pairs of supranasals (vs one), loreal scale row uninterrupted (vs usually interrupted by prefrontal), ventral body scales transversely enlarged (vs equal in size to more lateral scales) and a broadly banded head pattern (vs finely variegated).

*D. f. petersoni* differs from *D. elegans* in having 67-78 ventral scales (vs 77-82), a broader snout, and the pale auricular band passing transversely across the entire width of the ear (vs angled obliquely along rostrodorsal margin of ear, and entirely separated from a second, postauricular pale bar extending dorsally from the throat to the caudoventral margin of the ear).

*D. f. petersoni* differs from *D. molleri* in attaining a larger size (maximum SVL 128.5 mm vs 111 mm), and in having two pairs of supranasals (vs one) and a strongly banded throat (vs immaculate pale throat).

The known distribution of *D. f. petersoni* overlaps those of only two other species of *Delma*: *D. australis* and *D. butleri*, all three having been taken at 15 mi. N. Poochera, S.A. Comparison with *D. australis* is made above. *D. f. petersoni* differs from *D. butleri* in having 18 midbody scales (vs usually 16), and a dark head (vs head concolorous with body) with strongly banded throat (vs immaculate pale throat).

#### *Habitat*

The limited habitat data associated with specimens suggests that *D. fraseri petersoni* is associated with *Triodia* habitats (Schwaner *et al.* 1985). The holotype was collected in a pitfall trap on a sand dune with spinifex and some *Callitris*; SAM R20816 in a pitfall in a dune system with *Triodia* and mallee; SAM R20790 in a pitfall in sandy soil with *Triodia* on the lower part of a dune slope, while SAM R14985 was taken from *Triodia* in an interdune flat with mallee. In Western Australia, WAM R100636 was taken from *Eucalyptus concinna* mallee over *Triodia basedowii*, and R100930 from marble gum woodland over *Triodia basedowii* on a yellow sandplain.

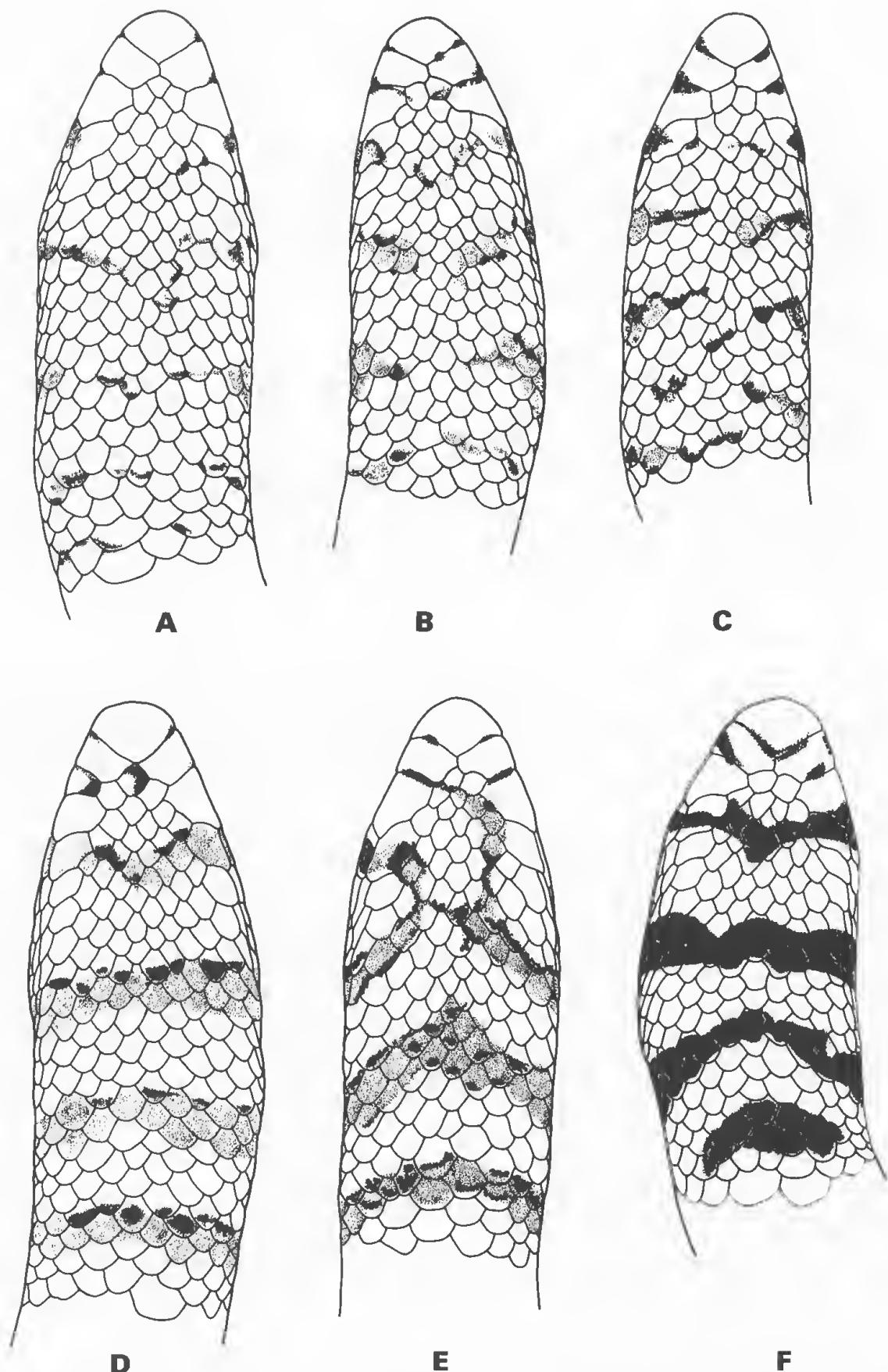


FIGURE 6. Comparison of throat patterns of *Delma f. fraseri* (A. AM R11115; B. AM R11651; C. AM R81700) and *D. f. petersoni* (D. SAM R14985; E. SAM R20790; F. SAM R33681).

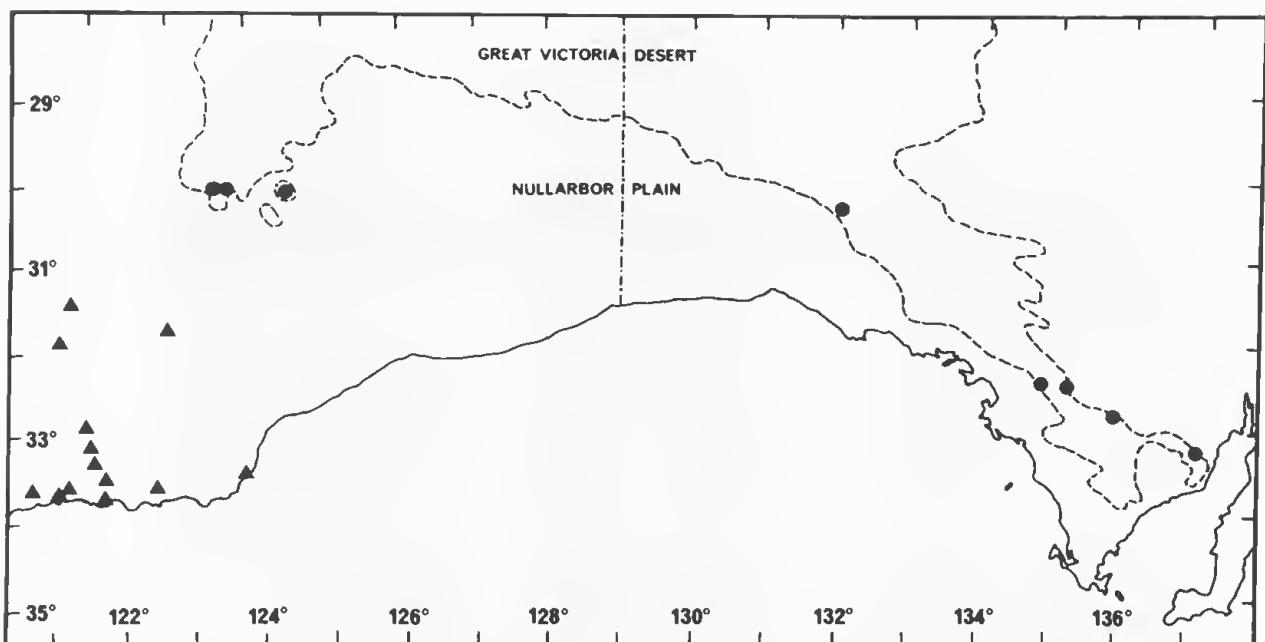


FIGURE 7. Distribution of *Delma fraseri petersoni* (dots) and nearest populations of *D. f. fraseri* (triangles). Dashed line represents approximate limit of sandridge systems of the Great Victoria Desert.

### *Etymology*

Named for Magnus Peterson, of Perth, W.A., who initially prompted my interest in pygopodids, and who has continued to offer much discussion on their systematics and natural history.

### *Remarks*

Although Kluge (1974) identified MV D2659 as *D. fraseri*, it agrees in all diagnostic characters with *D. butleri*, and lacks any trace of the dark head markings of *D. fraseri*. Consequently, I correct Kluge's identification of this specimen to *D. butleri*.

### *Comparative material of D. f. fraseri examined (all from Western Australia)*

AM R2443-44, R2446, 'Perth, etc.'; R3436, Canning River, Darling Range; R9890, R9956, R10005, R11649-51, R11665, R131829-32, Tambellup; R11111-2, R11115, R12129-32, R131833, Woodlands, Tambellup; R81698, Esperance tip; R81699-700, 1.2 km E Ravensthorpe; R114824, Hopetoun; R131834, no locality; R133847, Esperance Chalet Village, end of Goldfields rd, NE Esperance; R133914, R133989-90, R134036, R134064, R134080, R134369, old rubbish tip just E Salmon Gums; R134273, SW side Grass Patch; R134372, vicinity of Scadden; BMNH 67.2.19.28, 30, Champion Bay; 97.3.23.3, 1931.7.1.104-107, W.A.; 69.5.25.24-25, 69.5.25.29, Perth; 1966.411-412, Victoria Park; 1966.413, Bunbury; 1966.414, Wandering; 1966.416, Williams; 1966.417, Bengor; 1966.419, Nungarin; SAM R22828, WAM R75860-61, Lort River, Coomalibidgup; SAM R22911, Coomalibidgup tip; R22935, Burns Beach; R23258, 1 km N Wagin; R29406, 21 km N Geraldton; R29511-12, WAM R14786, Esperance; WAM R7463, Bodallin; R21993, 8 km E Gibson; R29660,

Parker Range area; R29661-62, 43 km S Southern Cross; R31089, R31113, R66885, R67208, R67213, R93330-31, Israelite Bay; R36235-36, Munglinup; R37832, Split Rocks; R71179, North Ironcap; R72354, near Heartbreak Ridge; R86622, R86679, Lort River Station; R93557, Widgiemooltha; R95553, Condungup.

### *Delma impar* (Fischer, 1882: 287).

#### *Diagnosis*

A moderate-sized species of *Delma* (SVL up to 101 mm) with single pair of supranasals, fused rostrally with first supralabial and caudally with postnasal, two preanal scales, and usually with a series of distinct narrow pale stripes laterally and dorsolaterally on body and tail, with series of dark spots between these stripes.

#### *Description*

See Kluge (1974).

#### *Distribution*

In South Australia, known only from the south-eastern border area (Fig. 8). The South Australian localities are at the western extreme of the distribution in Victoria and south-eastern N.S.W. (Kluge 1974).

#### *Remarks*

Kluge (1974) differentiated this species from other *Delma* primarily on the fusion of the supranasal to the first supralabial, a character not noted for

any other *Delma*. However, two specimens of *D. plebeia* I have examined (AM R12485, Qld; R98656, 5 km N Bulga, N.S.W.) show the same complex fusion of supranasal to both first supralabial and postnasal. These two species, together with *D. torquata*, share the derived character state of only two preanal scales, and may constitute a species group, the *D. impar* group, occurring in south-eastern Australia, especially in basaltic soils.

#### *Specimens examined*

**Australian Capital Territory:** AM R14349, Barton; R31621, Gungahlin.  
**New South Wales:** AM R9639, nr Tumut; R11245, Gilmore; R64276, 14.5 km N Batlow at Wondalga (off old Tumbarumba rd).  
**South Australia:** SAM R8387, R9977, R10060-61, R10715-22, R11143, R12666-68, Bool Lagoon; R8782, 3 mi. E Naracoorte.  
**Victoria:** AM R8777, Mt Hope; BMNH 98.10.19.7, nr Melbourne.

#### *Delma inornata* Kluge, 1974: 101.

##### *Diagnosis*

A large species of *Delma* (SVL up to 135 mm) with modally 16 midbody scales, 1-2 pairs of supranasals, caudal pair (when present) moderately to broadly separated from nostril, and no dark head or throat markings.

##### *Description*

See Kluge (1974) and Shea (1987b).

##### *Distribution*

In South Australia, apparently restricted to the vicinity of Lake Alexandrina and the lower reaches of the Murray River (Fig. 8). Widespread in Victoria, N.S.W., and south-eastern Queensland (Shea 1987b).

##### *Remarks*

As noted by Shea (1987b), Kluge misidentified a number of specimens of *D. butleri* as *D. inornata*. To those misidentifications can also be added MV D15453-54, from Renmark (J. Coventry, *pers. comm.*). It seems likely that the South Australian population is isolated from the main part of the range of this species in N.S.W. and Victoria. The South Australian population has a high frequency of individuals with only a single pair of supranasals (78%,  $n = 9$ ).

##### *Habitat*

Three specimens (R21001, R23870, R26138) were found under rocks. It is probable that the South Australian population inhabits open grasslands, like eastern populations (Shea 1987b).

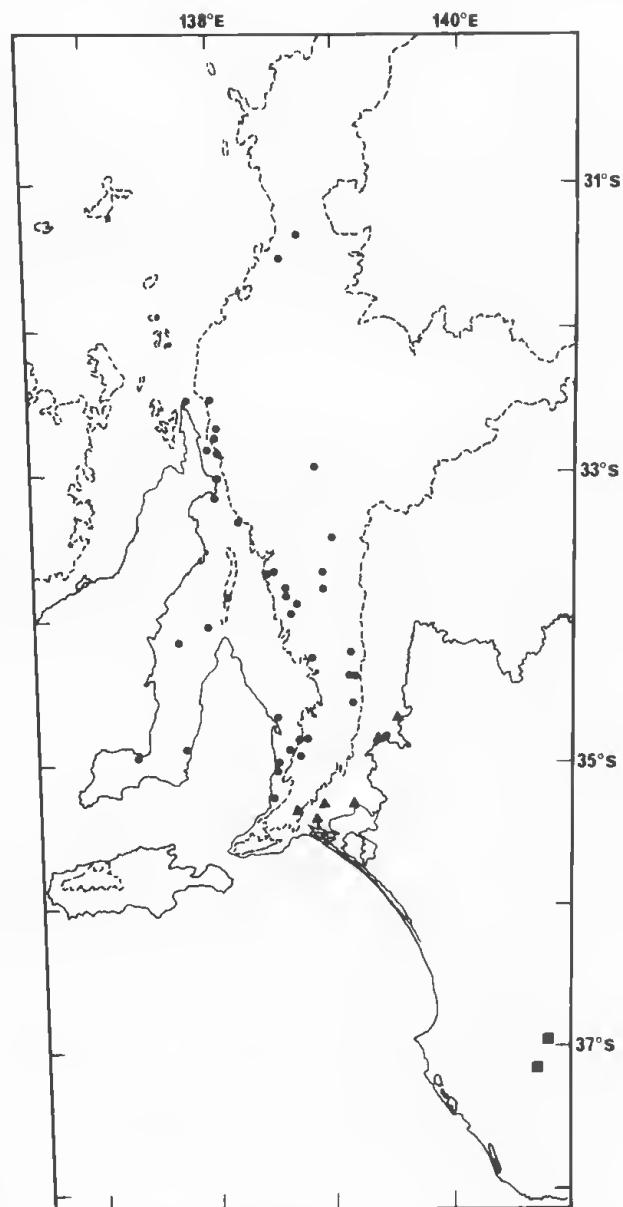


FIGURE 8. Distribution of *Delma impar* (squares), *D. inornata* (triangles) and *D. molleri* (dots) in South Australia. Dashed line represents 200 m contour.

#### *Specimens examined*

**New South Wales:** SAM R11095, 20 mi. N Walla Walla. See Shea (1987b) for other records from New South Wales and Victoria.

**South Australia:** SAM R12745, Tooperang; R17440, between Mannum and Purnong; R18648, 5 km N Walkers Flat; R18971, ca 16 km W Milang; R21001, River Marne; R23530, R23870, R26138, Lake Alexandrina; R32798, Strathalbyn.

***Delma molleri* Lütken, 1863: 296.**

*Diagnosis*

A moderate-sized species of *Delma* (SVL up to 111 mm) with modally 18 midbody scales, a single pair of supranasals, dark dorsal head markings (of reduced intensity in large adults) and an immaculate pale throat.

*Description*

See Kluge (1974).

*Distribution*

Restricted to South Australia, to the Adelaide Plains and Yorke Peninsula and adjacent ranges, from the vicinity of Oraparinna H.S. in the north, east to 'between Mannum and Purnong' and south to Reynella (Fig. 8). The record from Hattah, in Victoria (AM R84295-96) is from a captive collection, along with other *Delma* specimens, and in the absence of any corroborating evidence is considered erroneous.

*Habitat*

Most specimens of this species for which data are available were found under rocks ( $n = 17$ ), tin or other rubbish ( $n = 11$ ) or timber ( $n = 2$ ). A variety of vegetation types and topographies is inhabited, including 'sclerophyll scrub', 'tall grass in agricultural country', 'largely bare hills with occasional chenopods and mallees', 'Acacia-scrub covered hilltop', 'eucalypt woodland on red soil with stones and sedges, scattered Casuarina and Acacia in understory', 'grass and rocky land adjacent creek', 'grassed sediment island in creek' and 'river flats'. Three of the Flinders Ranges specimens were taken in pitfalls in *Triodia* habitats.

*Specimens examined* (all localities except the first are in South Australia)

AM R84295-96, Hattah, Victoria [in error]; R89125, Peterborough; R115770, 3.3 mi. W Kulpara on Paskeville rd; R115813, 34°11'S 137°41'E, Yorke Peninsula; R115928, 2.5 mi. W 'Tracy'-'Caroona' rd on Mt Bryan rd; R115939-40, 4.2 km NW Mintaro on Hilltown rd; R115943-44, 33°40'S 138°30'E; BMNH 92.5.18.1, S.A.; 1923.11.11.47, SAM R1470, R12672-73, Mt Lofty; BMNH 1962.810, Morialta; 1962.811, Clare; SAM R1584, R16056, Black Hill; R2233, Mt Lofty Range; R3021, Dunstone Quarry, Burnside; R6362-70, few miles N Burra; R8140, Hummock Mt; R11186-87, 1 mi. NE Tea Tree Gully; R12514-15, N of Wilmington, on towards Mt Brown; R12550, 4 mi. E 1 mi. N Truro; R12591, 2.5 mi. S 2.5 mi. W Stansbury; R12624, R12671, Point Turton; R12918, Mambray Creek; R13150, Seacombe Gardens; R14028, Mambray Creek National Park; R14462, Mt Brown; R14656a-b, 26.5 km N 5 km E Burra; R15625a-b, 3 km E Truro; R16006, nr Port Augusta, on old Port Augusta-Wilmington rd; R16952, ca 5 km S Wilmington; R16954, Mt Remarkable National Park; R17464, Hallet Cove

Conservation Park; R17642, between Mannum and Purnong; R17943, R25360, Wilpena Pound; R18856, 6 km SE Keyneton, nr Sedan Hill; R19018, 5 km N Clare; R20581, Burra Creek Picnic Reserve; R20825, 8 km N Auburn; R22539-40, Telowie Beach; R22787, R23088, R23106, Mt Remarkable National Park, 2.1 km E Sugargum Lookout; R23136-37, R23139, R23144, Mt Remarkable National Park, 2.6 km from Scarfe's Hut; R23143, Mt Remarkable National Park, Alligator Gorge; R23894, St Kilda; R24200, 14 km S Burra; R24208-10, 11.2 km N Dutton; R24211-14, 1 km S Burra; R24862, nr Oraparinna HS; R25786-87, Reynella, R26121-22, Pt Pirie; R28362, R28628, Bowman Park Recreation Reserve; R30310-14, Rochester Historic Site; R31718, Aldinga; R32858, Para Hills; R32889, Anstey Hill.

***Delma nasuta* Kluge, 1974: 109.**

*Diagnosis*

A moderate-sized species of *Delma* (SVL up to 112 mm) with usually 16 or more midbody scales, fourth supralabial below centre of eye, long narrow snout (Fig. 3), usually five or more loreals, dorsal scales pale brown with a dark apical spot, and ventral scales usually basally edged with dark brown.

*Description*

See Storr (1987) and Storr *et al.* (1990).

*Distribution*

Arid *Triodia* habitats of Northern Territory, south of Spring Creek, Barrow Creek and 'Fish River', and far north-west corner of South Australia (Fig. 9). Also occurs in western Queensland (Shea 1987a) and northern and central Western Australia (Storr 1987).

*Habitat*

Like other populations (Kluge 1974; Storr 1987), Northern Territory populations of *D. nasuta* are apparently *Triodia* inhabitants. The six specimens for which microhabitat data are available were found in *Triodia*. One specimen (AM R80364) was found active on a road at 2020 hrs.

*Specimens examined*

**Northern Territory:** AM R12013, Mt Gillen; R80364, 33 km S Barrow Creek; R84566, 50 km S Alice Springs on Stuart Hwy; R120116, Dead Bullock Plains, 'Tempe Downs'; R130666, 5 mi. W 'Narwietooma'; BMNH 1973.3286, Kintore Range (23°22'S 129°26'E) (formerly JSE 305); CAWC R10, Hermannsburg; R20, 'Fish River'; CAWC R301, NTM R1590, R1601, R1869, R1871-72, R1891, Maryvale; CAWC R764, Yuendumu Settlement; R919, 20°02'S 130°16'E, Tanami Desert; R1062, Bonney Creek, 'McLaren Creek'; R1322, Ayers Rock; R1463, 23°52'S 135°42'E, Simpson Desert; R1494, 'Todd River'; R1647, Trepינה Gorge; R2003-05, R2013, 'Tempe Downs'; R2008-09, George Gill Range; R2010, Ooraminna; R2011-12, Mt Peachy; NTM R1593, 20 km N Maryvale;

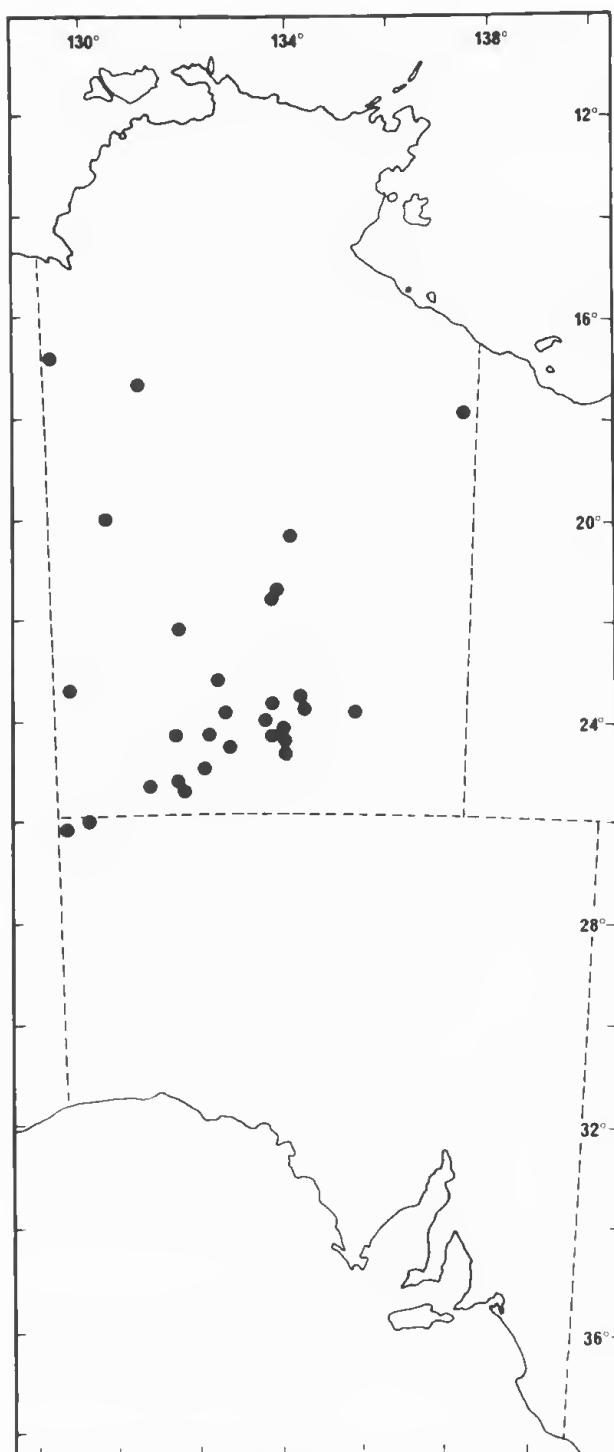


FIGURE 9. Distribution of *Delma nasuta* in the Northern Territory and South Australia.

R1621, 28.5 mi. S Alice Springs; R5568, SAM R18721, Alice Springs; NTM R5829, 'Wave Hill'; R6556, Barrow Creek; R12733-34, 'Tempe Downs', 25 km N Kings Canyon rd; SAM R29889, 7 km along 'Mulga Park' rd, SSE 'Curtin Springs' H.S.; R29940, 22 km along 'Mulga Park' rd, SSE 'Curtin Springs' H.S.; WAM R20816, 'Angas Downs'; R24354, 6 mi. SW Barrow Creek; R55348, R55398, 'Maryvale' H.S.; R60234-36, Spring Creek, 58 km N 'Wave Hill' H.S.

**Queensland:** AM R26010, Mt Isa; R49667, 193.7 km N Windorah; R110542, R110609, 14 km NE Scott's Tank, 'Diamantina Lakes'; R125040, between Mt Isa and 100 km to NW.

**South Australia:** AM R17310-15, R17376, R17646, R17939, Mt Davies, Tomkinson Range; R17535, Mann Range.

**Western Australia:** AM R105732-34, 28.3 km N 'Nanga' turnoff on Denham rd; R111132, SAM R13444, Wittenoom Gorge; CAWC R452, Balgo Mission; R1429, Giles Meteorological Station; NTM R6664, Nicholson River Gorge, 'Nicholson'; R6762, 16.3 km N Halls Creek; R7035-37, between Fitzroy Crossing and Halls Creek; R7282-85, 167 km E Fitzroy Crossing; SAM R12675, Warburton Range; R29375, 34 km S Denham; R29379, 24 km S Denham.

#### *Delma tincta* de Vis, 1888: 824.

##### *Diagnosis*

A small to moderate-sized species of *Delma* (maximum SVL 92 mm), with usually one pair of supranasals, third supralabial in subocular position, 14 midbody scales and, in juveniles and subadults at least, a dark head dorsally and laterally, with narrow pale bands (one preocular, one postocular, one auricular, one nuchal), but mid-throat region immaculate, pale.

##### *Description*

See Kluge (1974) and Storr *et al.* (1990).

##### *Distribution*

Southern two-thirds of Northern Territory, south of 'Wave Hill', Tennant Creek, 'Anthony Lagoon', Borroloola and 'Bing Bong', with possible isolates further north in the Katherine district (one specimen) and far northern coast (Yirrkala to Oenpelli, and possibly as far west as Humpty Doo). In South Australia, apparently restricted to the north-eastern quarter, extending south-west to 'Erudinna' (Fig. 2).

Also widespread in Queensland and northern N.S.W. (Shea 1987a) and central-west Western Australia and the Kimberley (Storr *et al.* 1990).

##### *Remarks*

Kluge (1974) reports widespread sympatry of *D. borea* and *D. tincta*. This does not appear to be the case in the Northern Territory or Queensland. Rather, they seem to have largely complementary distributions. In the Northern Territory, the two species have been collected in close proximity only at 'Wave Hill' (five *D. borea*) and old 'Wave Hill' (one *D. tincta*), in the Katherine district (three *D. borea* from Katherine and district, one *D. tincta* from Katherine Farms rd and another from 'Katherine district'), at Humpty Doo (one *D. borea* and one *D. tincta*, the latter from 'Humpty Doo district'), and in the Alice Springs area (two *D. borea*

from Heavitree Gap, one from Alice Springs, 35 *D. tincta* from Alice Springs). At Yirrkala, three specimens are typical *D. borea* in all three sculation characters, while one specimen has the single pair of supranasals and third supralabial subocular of *D. tincta*, but the 16 midbody scale rows of *D. borea*, the latter character only otherwise seen once in 111 Australian Museum *D. tincta*. Further collections are needed to determine whether this specimen is really *D. tincta*, or an aberrant *D. borea*. Only in the case of two specimens (NTM R3791-92) from 'Katherine district' have the two species been possibly collected synchrosympatrically.

The single record for Renmark (NTM R1166) is considered to be erroneous. The Renmark area is otherwise well-known herpetologically, and over 325 km south of the next nearest record.

#### Habitat

In the N.T. and S.A., specimens have been recorded under rubbish ( $n = 7$ ), in leaf litter ( $n = 5$ ), under dead *Triodia* ( $n = 2$ ), under rock ( $n = 1$ ) and in a disused ant nest under a rock ( $n = 1$ ). Habitats included grassland ( $n = 3$ ), mulga plain ( $n = 1$ ), red soil plain ( $n = 1$ ) and black soil plain ( $n = 1$ ). Four specimens were found active on roads between 1915 and 2100 hrs, while one was active in long grass at 1300 hrs.

#### Specimens examined

**New South Wales:** AM R4123, Clarence River; R16683, R60469-72, Bingara; R18582, Croppa Creek; R32595, 'Harriearra', via Tibooburra; R44737, junction of Teatree Creek and Horton River, 30 km WSW Bingara; R51703, 13 mi. E Manilla on Retreat rd; R51704-05, 0.7 mi. S Woolomin; R63985, 2 mi. S Barraba; R64330, Yalleroi; R86219, 'The Brothers', North Star; R87537-45, Moonbi Lookout; R104309, Tamworth; R105969, Chunky Creek, 'Mt King'; R107713, Moree; R110672, nr Menindee; R118978, R129322, Manilla Tip.

**Northern Territory:** AM R11529, Plenty River; R12364, Yirrkala; R26398, nr Peterman Ranges, 61 mi. from W.A. border; R26477-78, R26499, vicinity of Finke; R31624, Smoke Hills, Tanami Desert; R50963, CAWC R11-17, R1070, R1350, R1561, R1805-06, R2232, R2341, R3021, R3124, R4806, R5448, R5889, R5909-10, NTM R531, R5558, R5563, R5567, R8621, Alice Springs; AM R52131-32, R52134, Greenleaves Caravan Park, Alice Springs; R52133, Alice Springs Airport; R54923, 65 km upstream from sea, Liverpool River; R54924, 20 km upstream from sea, Liverpool River; R55355, 'Bing Bong', via Borroloola; R80363, 20 km W Qld/N.T. border on Barkly Hwy; R80368, 29 km E Three Ways on Barkly Hwy; R84549, 25 km N Alice Springs on Stuart Hwy; R84565, Henbury Meteorite Reserve, 146 km N Kulgera on Stuart Hwy; CAWC R291, 10 km N Deep Well; R495, Borroloola; R502, NTM R6484-86, R8416-18, R8513, R8811, Frewena Roadhouse and vicinity; CAWC R622, 'Alexandria' H.S.; R1205, R1212, Maryvale; R1262, R1330, Simpsons Gap; R5909, St Phillips College, Alice Springs; NTM R101, Katherine Farms rd; R700, Railway Yards,

Alice Springs; R910, Oenpelli; R1573-74, Tanami Bore; R1861, Mt Gillen; R2467, Bradshaw Drive, Alice Springs; R3679-80, 'Brunette Downs' H.S.; R3792, Katherine district; R5278, Telecom Building, Alice Springs; R5391, Mt Watt, ca 25 mi. NW 'Horse Shoe Bend'; R5392-93, Mt Sunday Range, 190 km S Alice Springs; R5742, Whycliffe Well; R6557, 10 km N Alice Springs; R6622, old 'Wave Hill' H.S.; R8544-51, R9557-64, Alroy Downs; R8557, 64 km N 'Alroy Downs'; R8604, 7 km N Three Ways; QM J21786, Humpty Doo district; J26982, MIM mine, MacArthur River; SAM R8062, Tennant Creek; WAM R55406-07, R55440, 71 km W Barry Caves; R78239, 70 km W Barry Caves.

**Queensland:** AM R2283, Bloomfield River, Cooktown; R5853, Oakey; R7003, R10237, R84394, Cooktown; R9361, 118 mi. N Rockhampton; R9453, Winton; R11653, Cunnamulla district; R12321, Proserpine; R13010, Hughenden; R13801, Townsville; R17028, Laura; R17080, Gregory Springs via Hughenden; R31628, R31631, Mt Isa district; R37484, 15 mi. from Proserpine on Shute Harbour rd; R12201-02, Brooklyn, Winton; R13714, Mungai Junction; R16347, R16684, R16686, 'Silver Plains'; R16671, Lappa Junction; R21131, Cunnamulla; R50209, 'Tullochard', 78 mi. SW Mitchell; R51524, Grassy Hill, Cooktown; R55612, R58482, 'Giruth Plains'; R56816, 10 mi. S Gayndah; R60249, 1.6 km E Camooweal; R61577, Lizard Island; R62301, 80.1 km N Muttaburra on Hughenden rd; R62459-62, R62706, 62.4 km N Muttaburra on Hughenden rd; R62490-95, ca 23.7 km NW Aramac turnoff via Muttaburra rd; R63056, Clermont; R63110, WAM R21420-22, Charters Towers; AM R63333, Croydon Tip; R63431, just NE Karumba; R63574, 0.7 km S airport entrance via old Croydon rd; R63615-17, 8.1 km W Croydon rd; R63692, 23.9 km E Croydon P.O. via Gulf Hwy; R63714, Crooked Creek at Gulf Hwy, 34.5 km W Georgetown; R81701-02, 6.6 km SE Greenvale by rd; R81703, Charters Towers Tip; R81704, 25.2 km N Yeppoon via Byfield rd; R84404, 22.0 km S Townsville on hwy; R90213, 63 km W Winton on Boulia rd; R90214, 55 km SE Winton on Landsborough Hwy; R105152, Weipa regeneration area; R113228-29, Mayne Junction Bore, 'Diamantina Lakes'; R128219, R128857, Mandalee, Innot Hot Springs; BMNH 1924.3.3.22-26, 'Alice Downs', Blackall.

**South Australia:** NTM R1166, Renmark [in error]; SAM R14498, Flinders Ranges; R15189a-c, 'Erudinna'; R18254, R18262-63, R32453, Coongie Lake; R30970-71, 'Coongie'; R30976, 8 km SSE 'Coongie'; R31173, 27°12'S 140°08'E, Cooper Creek area.

**Western Australia:** AM R4939; R40529-30, NTM R13084, 3 mi. S main Ord River Dam; AM R100565, 26.9 km N Wittenoom-Newman rd via Port Hedland rd; NTM R9940-41, Wyndham.

**No data:** NTM R331, R2973, R9855-57.

#### A KEY TO THE DELMA OF SOUTH AUSTRALIA AND THE NORTHERN TERRITORY

- 1 — Ventral scales not transversely enlarged; loreal scale row usually interrupted by prefrontal scale . . . . . *australis*
- Ventral scales transversely enlarged; loreal scale row complete, prefrontal separated from supralabials . . . . . 2

2 — Single pair of supranasals, fused with first supralabial rostral to nostril and with postnasal caudal to nostril; two preanal scales.....*impar*  
   — First supralabial and postnasal distinct from supranasals; three preanal scales.....3

3 — Usually 14 midbody scales; third supralabial scale subocular; one pair of supranasals.....*tincta*  
   — Usually 16 or more midbody scales; fourth supralabial scale subocular; one or two pairs of supranasals.....4

4 — Upper temporal single; size small (SVL  $\leq$  98 mm); head dark (paler in large adults) with narrow light bands; throat pale, immaculate.....*borea*  
   — Upper temporals two or more; size small or large; head pale or dark; throat with or without dark variegations .....5

5 — Usually 18 midbody scales; head darker than body (contrast reduced in large adults).....6  
   — Usually 16 midbody scales; head concolorous with body .....7

6 — One pair of supranasals; throat immaculate....*molleri*  
   — Two pairs of supranasals; throat with dark bands .....*fraseri petersoni*

7 — One or two pairs of supranasals; if two, caudal pair broadly separated from nostril.....*inornata*

— Two pairs of supranasals, caudal pair narrowly separated from nostril.....8

8 — Snout long, narrow; colour pattern (when present) of dark spots dorsally and ventrally.....*nasuta*  
   — Snout short; colour pattern (when present) of irregular complete or incomplete narrow pale bands over head.....*butleri*

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